CALIFORNIA DIVISION OF MINES AND GEOLOGY

Fault Evaluation Report FER-34

March 30, 1977

1. Name of fault: Santa Ynez fault (central segment).

2. Location of fault: Santa Barbara and Ventura Counties (see figure 1). Only the area in Santa Barbara County will be discussed here. For a discussion of the fault in Ventura County see Smith (1976, FER-22).

3. Reason for evaluation: The fault lies in the ~~first years~~ 1976 study area of the 10-year program for fault evaluation in the state. Also, the Santa Barbara County seismic safety element classifies the fault as active.

4. List of references:

a) Dibblee, T.W., 1950, The geology of southwestern Santa Barbara County, California: California Division of Mines and Geology, Bulletin 150, 95 p., plates 1 and 2 (scale 1:62,500).

b) Dibblee, T.W., 1966, The geology of the central Santa Ynez Mountains, Santa Barbara County: California Division of Mines and Geology, Bulletin 186, 99 p., plate 1 (scale 1:31,680), plate 3 (scale 1:62,500).

c) Edwards, L., 1971, Geology of the Vaqueros and Rincon Formations, Santa Barbara embayment, California: University of California at Los Angeles, Ph.D thesis.

d) McCracken, W.A., 1969, Environmental reconstruction -- Sespe Formation, Ventura basin, California (abstract): Program 1969 annual meeting, Geological Society of America, p. 145-146.

e) Schroeter, C., 1972, Stratigraphy and structure of the Juncal Camp -- Santa Ynez fault sliver, southeastern Santa Barbara County: University of California Santa Barbara, Masters thesis.

f) Schmitka, R.O., 1973, Evidence for major right-lateral separation of Eocene rocks along the Santa Ynez fault: Geological Society of America, abstracts with Programs, v. 5, no. 1, p. 104.

g) Link, M.H., 1971, Sedimentary petrography, and environmental analysis of the Matilija sandstone north of the Santa Ynez fault: University of California Santa Barbara, Masters thesis.

h) Page, B.M., Marks, J.G., and Walker, G.W., 1951, Stratigraphy and structures of the mountains northeast of Santa Barbara: Bulletin American Association of Petroleum Geologists, v. 35, no. 8, p. 1727-1780.

i) Hamilton, R.M., Yerkes, R.F., Brown, R.D., Burford, R.O., De Noyer, J.M., 1969, Seismicity and associated effects, Santa Barbara in Geology, Petroleum development, and seismicity of the Santa Barbara channel region: U.S. Geological Survey, Professional Paper 679-D, p. 47-68.

j) Jennings, C.W., 1975, Fault Map of California: California Division of Mines and Geology, Geologic Data Map Series, Map no. 1, scale 1:750,000.

k) Ziony, J.I., Wentworth, C.M., Buchanan-Banks, J.M., Wagner, H.C., 1974, Preliminary map showing recency of faulting in coastal southern California: U.S. Geological Survey, Map MF-585, scale 1:250,000.

l) Sylvester, A.G., 1976, Personal communication of March 28, 1976.

m) Moore and Taber, 1974, Santa Barbara County comprehensive plan -- seismic safety element, 93 p.

n) Geotechnical Consultants, 1977, Santa Ynez fault study in the vicinity of Juncal reservoir, report in progress (personal communication only in this report).

o) Smith, T.C., The Santa Ynez fault in ventura County: California Division of Mines and Geology, Fault Evaluation Report, FER-22.

p) NASA, 1973, U-2, false color IR photographs: Flight number 73-194, roll 01541, frames 6519-6521.

5. Summary of available data:

Moore and Taber (1974) give an accurate summary of most of the available literature concerning the Santa Ynez fault. Following this excerpt from their report, I will comment on their interpretation of the activity along this fault.

> "The Santa Ynez fault trends east-west 75 miles from its intersection with the Agua Blanca thrust fault in wastern Ventura County to Gaviota Pass in western Santa Barbara County. At Gaviota Pass the Santa Ynez fault splits into a south branch which intersects the coast 7 miles to the southwest, and a north branch which continues 7 miles further west. The fault system is characterized as a high angle, oblique-slip fault with considerable left lateral slip. Along most of its course the Santa Ynez fault marks the base of the steep north-facing escarpment of the Santa Ynez Range; the south block of the fault has been uplifted to form the mountain range. The maximum vertical separation at

the base of Eocene sediments indicated on structure sections (Dibblee, 1950, 1966) is about 9500 feet. Dibblee (1966) has noted that the Tertiary sedimentary rocks on opposite sides of the Santa Ynez fault are vastly different. He believes that the differences may be explained by several miles of horizontal displacement, the north block having moved west.

Some investigations have supported Dibblee's hypothesis of such major horizontal displacement. Edwards (1971) suggests 37 miles of horizontal movement of lower Miocene sediments along the Santa Ynez fault, and McCracken (1969) believes that Oligocene sediments are horizontally displaced 12 miles. On the basis of a detailed study of Eocene sediments, Schroeter (1972) has suggested 9 miles (15 km) of horizontal displacement. In contrast Schmitka (1973) believes that Eocene rocks have been horizontally displaced 30 miles; however, he indicates that the north block of the fault has moved east. This is opposite to the movement direction suggested by Dibblee (1966) and the other investigations summarized above.

Other geologists question whether significant horizontal displacement in either direction has occurred along the Santa Ynez fault. Link (1971) believes that a maximum of only 1-2 miles of post Eocene horizontal displacement has occurred. Opinions on the magnitude and direction of horizontal movement on the Santa Ynez fault are too contradictory to determine earthquake recurrence intervals from the long-term horizontal slip rate as has been accomplished for the Big Pine and San Andreas faults.

> Recent horizontal movement is indicated by displacements of stream courses of a few hundred feet to 3 miles (Dibblee, 1966) and possible offset of Pleistocene terrace deposits (Page, et al., 1951). According to Arthur G. Sylvester (personal communication in Sage, 1972), scarps and sagponds occur along the Santa Ynez fault north of Carpenteria. Jennings (1972) indicates that Quaternary displacement has occurred over the entire length of the Santa Ynez fault. A magnitude 7.5 earthquake occurred off of Point Arguello in 1927; Hamilton, et al. (1969), has suggested that the earthquake occurred on a western extension of the Santa Ynez fault. This epicenter is aligned with the Pacifico fault (California Department of Water Resources, 1964), which is a member of the Santa Ynez fault zone."

1) The evidence for or against any significant amount of strike-slip offset along the Santa Ynez fault is inconclusive and contradictory. Page, et al. (1951, p. 1770) state that "there are at least three or four cases where different stream drainages crossing the fault are offset in opposite directions."

2) Page, et al. state that "a broad dissected terrace, 150 feet higher than the present creek, has a shallow furrow along its surface. This furrow parallels the fault and appears to have minor ponding along its course." Ziony, et al. (1974) noted this feature but assigned it a late Pleistocene age, probably based on the 150 foot elevation of this terrace surface (see locality 1, plate 1 in this report).

3) Sylvester (1976) reports a scarp in alluvium at locality 2 (see plate 1). Ziony classifies this feature as late Pleistocene. The age of the alluvium was determined to be pre-Holocene. Geotechnical Consultants have trenched across the fault in the area within one quarter mile east of locality 2 (plate 1). Dave Gardner (P.C. 1977) stated that "no evidence of faulting was found in any trench." However, he also stated that "Wood fragments taken from the bottom of the trench were only 280 years old based on carbon-14 dating." Further, Gardner states that, "no evidence of Holocene activity was found along the Santa Ynez fault as far west as State Highway 154.

4) The magnitude 7.5 earthquake off Point Arguello in 1927 reported in Hamilton, et al. (1969) is said to be located on the Pacifico fault. This fault is a possible west extension of the Santa Ynez fault. The accuracy for epicentral plotting in 1927 was only within a 10 mile radius, hence, the Pacifico fault can't be positively designated as the causitive fault for this earthquake.

5) Smith (1976) found no Holocene evidence along the Santa Ynez fault to the east in Ventura County. He bases this opinion on existing literature and large scale air photos that he checked.

6) Ziony, et al. used Dibblee, primarily, to compile the Santa Ynez fault onto his map. They show no evidence of Holocene activity anywhere along the fault. Their classification for this fault is late Quaternary.

6. Air photo interpretation:

The area between Gaviota Pass and Lake Cachuma (shown on plate 1 with red triangles) was examined using U-2 high altitude photos at a scale of 1:125,000. The Santa Ynez fault can be seen to generally follow the

base of the steep, north-facing escarpment of the Santa Ynez mountains. East of this area the fault follows the course of the Santa Ynez river valley.

7. Field observations:

Time did not allow for field work along this fault. Also, since the available literature didn't report any Holocene units to be offset, field work became expendible.

8. Conclusions:

The principle sense of movement along the Santa Ynez fault is not positively determined. Dip-slip movement is well-documented, but the evidence for strike-slip movement is inconclusive. The fault seems to be a fairly well-defined surface feature (on small-scale maps), though trenching near Juncal reservoir proved fruitless in finding the fault. If this fault is a strike-slip fault then its activity level must be at a fairly low rate, because no recent topographic features indicative of strike-slip faulting have been observed anywhere along its surface extent. The 1927 epicenter can't be placed, with any degree of accuracy, on the Santa Ynez fault.

9. Recommendations:

I recommend not zoning the Santa Ynez fault for special studies at this time. However, I do recommend that further detailed mapping of Quaternary units along the fault be done in order to determine the youngest units faulted.

10. Investigating geologist's name; date:

I concur with recommendations. Perhaps a federal coop with USGS and/or Santa Barbara County would be worthwhile. EJBA 4/1/77

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